Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of

Petition for Declaratory Ruling Regarding Treatment of Rulemakings and Waivers Related to New Equipment and Services at Frequencies Greater Than 95 GHz	))))	ET Docket 13-259

I am a former AT&T researcher with Shannon Laboratories New Jersey where I specialized and researched the use of high frequency mm Wave, THz and laser based optical communications for extreme high capacity wireless networks. It is my well founded belief that we are in a unique period of history, a period where there is both a growing recognition of the capacity challenges to our existing wireless networks as well as the societal and business demand for more wirelessly delivered data. In parallel to these network and customer challenges new innovative wireless technologies, services, spectrum bands and network topologies are emerging that have the promise to solve our wireless network capacity problems .

The concern is simply that Shannon tells us there is an ultimate limit to the data that can be carried on our current wireless networks and their supporting frequency bands. We are already dangerously close to exhausting the capacity of this cellular and Wi-Fi spectrum, and there is precious little capacity left in our current network models to add in new types of data intensive wireless services.

What is clear from my 29 years with AT&T and ongoing current research is that we are also at a nexus point, the beginning of a wireless capacity struggle, a struggle between traditional voice and media services supported by traditional cellular and Wi-Fi networks, and the emergence of powerful new Big Data centric machine-to-machine M2M wireless communication systems. The emerging M2M Wireless data networks are designed to support the growing number of mobile machine communications devices,

sensors, autonomous vehicles, drones and their networks, as well as fixed wireless systems such as smart metering and smart homes.

New and data rich services, whether they be enhance human communications or machine-to-machine will only exacerbate the wireless networks growing capacity exhaustion, and without out a means to radically increase wireless network capacity there seem few good options left to us. It is likely the emerging M2M wireless networks will aggressively compete for same available spectrum and bandwidth used by our cellular and Wi-Fi networks. Without some means to mitigate and control such automatous systems, their wireless presence could potentially crowd out the wireless spectrum needed for human-to-human communications. Machine-to-machine wireless communications could be the tipping point that brings to an end the near interference free, low cost ubiquitous wireless services that is accessible for all and that we have grown to expect. An end of course for all but the very few who could afford to pay for increasingly limited and controlled services, ironically a situation somewhat reminiscent of the early days of cellular.

Smartphone intelligent agents (Avatars), future enhanced versions of the iPhones SIRI represent another type of machine-to-machine communications, one designed to interact at both the human level and as well as at the machine-to-machine communication level. The smartphone based intelligent agents will have profound effects on our quality of life. Along with a built-in suite of medical sensors, such enhanced smartphones will provide the human user a new and rich immersive 3 D virtual reality environment. Heads-up, gaming and immersive virtual reality headsets are already an available technology today.

When we imagine the future of wireless communications, often in movies and TV, we envision near future personal communication devices replete with 3D immersion and augmented virtual reality overlays with live high fidelity situation awareness video /data fusion, mostly body worn - possibly

implanted! But as exciting and important as these devices are, nobody discusses the reality of the wireless networks required to support such imagined super high capacity/data rate personal communicators. The capacity requirements, infrastructure and type of wireless links/frequencies required to carry such services and capabilities is simply assumed to exist and be common place. Perhaps it is the presumed existence of a super high capacity wireless network links that is the real fiction in this visionary scenario.

In reality, service providers today are working hard just trying to keep their wireless network capacity at an acceptable operational levels, trying frantically to add wireless network capacity where and when possible to try to support the ever increasing suite of data rich human wireless services. Add to this existing challenge the emergence and impact of machine-to-machine wireless networks and their capacity demands, then without some truly revolutionary network capacity enhancement, our wireless future may well be very bleak indeed.

Many researchers, companies and organizations such as the ITU and IEEE 802 and others around the world are working on approaches to off-load and transport the increasing Big Data component of our wireless experience independently of existing capacity limited wireless networks. One approach that has found favor is the creation of a new data dedicated wireless PHY layer operating in parallel to the existing wireless network. This new approach would use a routing device at the network fiber termination to separate out data from the network traffic going to the local cell tower. The router would redirect this data to the new dedicated wireless data network layer for localized distribution.

This new data wireless underlay layer would be based on a modified small cell distribution model, and deployed in large numbers and designed to back fill the traditional cellular coverage area. To provide suitable coverage in for example a city environment, many hundreds of thousands of these devices may need to be typically deployed. Manufacturability, low cost, ease of deployment and self-organizing/configuring networks become dominant issues and requiring a new paradigm of low powered

cooperative and intelligent edge devices that operate very differently from expensive large and power hungry macro/micro cells of today.

This new technology "data centric" layer would operate at much higher frequency bands than existing cellular and Wi-Fi systems. The new PHY layer would utilize new frontier spectrum and technology approaches required for high data carrying capacities, (mm Wave frequencies above 95 GHz). The revolutionary use of high frequency spectrum for mobile environments will in turn require the use of advanced radio processing technologies for high-gain beam forming and steering. Modeling of such technologies indicate the capability of transporting 100-1000 Gbps through the air for inter-small-cell backhaul, data forwarding and management as well as burst type data download links to the transiting customers M2M interfaces, and providing for the first time wireless capacity parity with optical fiber.

This new technology data PHY layer would use frequencies that are simply better suited to transporting large data than the frequencies already over utilized in existing cellular and Wi-Fi bands. These higher mm Wave and sub mmWaves frequencies would coexist and not interfere with the existing cellular infrastructure and traditional cellar and Wi-Fi bands. As an additional side benefit, routing big data to the data PHY layer would provide the opportunity to return much of the existing cellular spectrum currently tied up with data delivery to be returned back to enhance the capacity of voice services.

The rapid development of mm Wave transceivers in low cost CMOS silicon is already being driven by a number of industries including automotive RADAR. The development of low cost silicon CMOS RADAR transceivers from the automotive industry, raises the possibility that we are entering a new technology era when such mmWave and potentially sub millimeter Wave (THz) transceivers are being created by non-traditional, non-communications companies, driven by the need for low cost large volume applications and small package footprints (suitable for cars). But these low cost, mass produced, low powered transceivers potentially could also be used for applications such as small self-configuring

wireless data network devices designed to be deployed on street level light poles and powered street furniture.

This new paradigm for low cost enhanced street shaped small cells deviates dramatically away from the traditional large, expensive power hungry traditional cells model. Capacity enhanced small cells provide a new distribution model, one that is both power efficient and locally shaped and configured to optimize wireless service delivery in streets and public access areas – currently the bane of cellular service providers in city environments. This low power "green" data layer with its localized and highly directed steerable beams is the inverse of the existing omni-directionally broadcasting Macro and Microcells that require huge amounts of RF energy to blanket an area, and of which only an extremely small amount of this transmitted RF energy ever actually reaches the customer – the remaining transmitted energy is simply wasted.

The technology to build this new data layer with beam steering capabilities is quickly emerging out the research labs around the world. But the mm Wave and sub-millimeter Wave frequencies (95GHz and above) that are ideally suited for these new data centric wireless networks remains locked up, unallocated and unavailable to American industry and thus to the benefit of American society.

As a long term researcher in the communications industry it has been my experience that industry will not be drawn too nor invest development capital in spectrum and associated technologies if the spectrum is unnecessarily burdened with regulatory allocation issues, issues that could be very expensive for industry to address. Even more damaging for industries participation is that burdened regulatory processes could tie up the spectrums availability to industry for many years, such delays would stifle time sensitive economic opportunity that the spectrum and associated Research and Development. In the end the unnecessary burdening of the spectrum regulatory processes and delay in spectrum availability simply represents a lost opportunity for American industry and the American people.

But perhaps most the important issue regarding the spectrum allocation above 95 GHz is that today at a time when the powerhouse of American industry and innovation is faltering under the crushing forces of overseas competition, American industry is desperate for new ideas, innovations and markets to regain its strength. This at a time when the very life blood of our society and business – communications and our cellular infrastructure is reaching its inherent capacity limits. But yet the vast "new frontier" spectrum above 95 GHz and associated technology still remains unavailable to American society and American business. This spectrum represents an almost limitless resource of potentially super high capacity communications that could reach out to every aspect of society, sustain and future proof our communications infrastructure while stimulating the engine of innovation and creation for a new vibrant data centric economy, but yet this spectrum still remains unallocated and unused.

I believe we are at a historic moment in time, a time where our entrusted spectrum regulators have the precedent and the opportunity to support the future existence of super capacity wireless networks by the simple act of opening up and allocating spectrum above 95 GHz and then standing aside to let the engines of creativity start to turn. This bold but necessary action would unleash the awesome and creative power of American industry and innovation, creating new markets, and companies as well as new opportunities for services, jobs and revenue. But perhaps even more important to America's future, the release of critical new communications infrastructure and spectrum that will set the USA on the path to future proof our wireless networks for the long term strategic benefit of citizens of this nation and the world.

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